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ABSTRACT

This report describes the University of Wyoming's Portal School Program. The program provides inservice teacher training in science to elementary and secondary school teachers. Teacher workshops are organized so that teachers can explore and learn to implement new curricula in their science classes. The Portal School Program is a joint effort of the University and the public school district. The University is responsible for organizing University resources, establishing portal schools, and training, certifying, and supporting portal leaders; the school district is responsible for providing leadership and financial support, planning and conducting workshops, and assessing portal school progress. Financial support for the portal schools comes from the university, school district, tuition, and the National Science Foundation. (BB)

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EVALUATION OF THE PORTAL SCHOOL PROGRAM

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September 1973

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Arlene Fenske, Executive Secretary for the Minnesota Evaluation Project

Richard Clark, Roger Johnson, and W. Todd Rogers provided immense assistance in the preparation of this report. Each of them wrote reports from the site visitations which were used by the authors in preparing this report. Their discussions with the authors have illuminated the merits and concerns of the portal school program.

TABLE OF CONTENTS

	Page
Purpose and Design of the Evaluation	9
University Responsibilities in the Portal School Program	18
Organizing University Resources	19
Establishing Portal Schools	23
Training, Certifying, and Supporting Portal Leaders	25
School District Responsibilities in the Portal School Program	28
Providing Leadership and Financial Support	29
Planning and Conducting Workshops	31
Assessing Portal School Progress	41
Financing the Portal School Program	45
Portrayals of Four Portal Schools	49

PURPOSE AND DESIGN OF THE EVALUATION

The Minnesota Evaluation Project is a four-year project funded by the National Science Foundation (NSF). Its purpose is to evaluate in-service teacher training programs of five NSF Comprehensive Projects. During the second year (1972-73) of the evaluation project, we started to focus our evaluation on off-campus activities of the comprehensive projects which are designed to facilitate the implementation of curriculum changes in elementary and secondary schools. One of these components is the portal school program at the University of Wyoming. Other programs for the implementation of curricula have been developed by the other comprehensive projects and are being evaluated during the third year (1973-74) of the evaluation project.

In this section of the report we describe the purpose and design of the evaluation. The following persons participated extensively in the evaluation study:

Glenn H. Bracht, Assistant Professor of Educational Psychology at the University of Minnesota, was director of the evaluation.

M. Donald Campbell, Research Assistant for the Minnesota Evaluation Project, was actively involved in all aspects of the study.

Harry Fehrenbacher, Research Assistant for the Minnesota Evaluation Project, was actively involved in all aspects of the study.

W. Todd Rogers, Sampling Coordinator of Research and Analysis for the National Assessment of Educational Progress, assisted in planning the evaluation and was the leader of the secondary visitation team.

Richard C. Clark, Science Consultant for the Minnesota State Department of Education, was a member of the secondary visitation team.

Roger T. Johnson, Associate Professor of Elementary Science Education at the University of Minnesota, was a member of the elementary visitation team.

Purpose of the Evaluation

By the fall of 1972 the University of Wyoming's portal school program had been in operation for about two years. Hence we felt there had been adequate opportunity for the staff to resolve some of the initial problems which occur with the implementation of a new program. The timing seemed appropriate, therefore, for an evaluation of the potential usefulness of the portal school concept as a delivery system for the implementation of curricula in elementary and secondary schools. The purposes of the evaluation were:

1. To describe the portal school concept and identify the key factors in the operation of an effective portal school program.

2. To examine the concerns about the portal school concept and judge the merits and shortcomings of the portal school program.

3. To recommend ways in which a portal school program could operate effectively.

The evaluation did not focus specifically on the effects of the University of Wyoming's portal school program; in fact, only four instances of portal schools were selected for the evaluation design.

One reason for focusing on the usefulness of the portal school concept rather than on the effects of the Wyoming program was to satisfy several different audiences. Although the staff of the University of Wyoming Comprehensive Project may use this evaluation to modify the operation of their portal school program, the evaluation is intended primarily for other institutions which might design delivery systems for the implementation of curricula. The evaluation is also significant for the NSF Division of Precollege Education in Science, especially the Implementation Section of the Division.

Evaluation Design

The major activities in the evaluation of the portal school program are summarized in Table 1. The evaluation design was developed during the fall of 1972. Preliminary to work on the design, Bracht visited the Wyoming region in October to interview both university and school district personnel who have been involved in the portal school program. In November, Robert Stake consulted with the evaluation project and provided important ideas which helped in formulating the design.

TABLE 1

SCHEDULE OF ACTIVITIES IN THE EVALUATION OF THE PORTAL SCHOOL PROGRAM

Date	Activity
October 1972	Bracht interviewed the coordinator for the portal school program, science and mathematics supervisors who have established portal schools, and portal leaders.
October and November	Bracht, Campbell, and Fehrenbacher designed the evaluation study.
December	Evaluation plan was presented to the advisory committee of the Minnesota Evaluation Project.
January 4-5, 1973	Site visitation was made to the medium-sized elementary portal school by Bracht, Campbell, Fehrenbacher, and Rogers.
January and February	Questionnaires were developed by Bracht, Campbell, and Fehrenbacher.
February 20-28	Questionnaires were sent to four portal schools.
March	Questionnaire data were summarized. Plans were made for site visitations. Content and format of interviews were developed.
March 27-30	Site visitation was made to two elementary portal schools and the University of Wyoming by Bracht, Fehrenbacher, and Johnson.
April 10-13	Site visitation was made to the two secondary portal schools by Campbell, Clark, and Rogers.
April to July	Evaluation report was written by Bracht, Campbell, and Fehrenbacher after receiving descriptions and judgments from the two visitation teams.
June 18	Oral report was presented to the staff of the NSF Division of Precollege Education in Science in Washington, D.C. by Bracht and Clark.
September 1973	Reports are being distributed to evaluation audiences.

The evaluation design placed high priority on a comprehensive description of the portal school program. This description was obtained through relatively full portrayals of all aspects of four portal schools. The portrayals included both university and school district involvement in the portal schools. These portrayals were prepared by examining materials and facilities, observing portal school activities, administering questionnaires, and interviewing personnel in the program.

As the purpose of the evaluation evolved, it seemed that the portal schools selected for portrayal should represent specific types of portal schools. Rather than making a random selection from the population of portal schools in the Wyoming region (Wyoming plus parts of five other states), we felt the purpose of the evaluation could be satisfied better by selecting portal schools with the following characteristics:

1. Both elementary and secondary portal schools.

2. Portal schools from both large and small school districts.

3. Portal schools from both school districts with science supervisors and school districts without science supervisors.

A list of science portal schools was obtained from the program coordinator. The information included the school district in which the portal school is located, date of first portal school workshop, whether elementary or secondary, content of workshops (exploration, implementation, or creative expansion), and degree of activity (low, moderate, or high).

We decided first to select only active portal schools for portrayal. Although useful information could be obtained from the evaluation of relatively inactive portal schools, we felt that our limited resources could be used more effectively by including four active portal schools in the design. Furthermore, many members of the evaluation audience would be interested in how to establish successful portal school programs in their areas. Hence, information about what is working would be more useful than information about inactive portal schools.

Since the cost of these portrayals would be high, only four portal schools were selected for portrayal. These were:

A. An elementary portal school in an urban school district with 93,000 students.

B. An elementary portal school in a medium-sized school district with 14,000 students.

C. A secondary portal school in an urban school district with 93,000 students.

D. A secondary portal school in a sparsely populated region of approximately 17,000 square miles. This region includes eight school districts with a total of 11,000 students.

The two portal schools in the urban area are in the same school district. This school district has two full-time science supervisors. The medium-sized school district has a half-time science supervisor, but the position was established after the portal school began. In the fourth portal school there is a science supervisor in the school district where the workshops are conducted, but the other school districts in the region do not have science consultants. A unique feature of this portal school is that it serves multiple school districts.

Data Collection

The portrayals of the four portal schools are based on site visitations and questionnaires. During the site visitations we interviewed teachers, principals, portal leaders, and science supervisors, observed teacher workshops, and examined materials and documents which relate to the portal school.

The initial site visitation was made to the elementary portal school in the medium-sized school district in January 1973. Its purpose was to gather preliminary data which would help us in constructing questionnaires and planning later site visitations. The visitation team consisted of Bracht, Campbell, Fehrenbacher, and Rogers. Rogers was included because he would be the leader of the secondary visitation team in April. We interviewed both teachers who had participated in portal school workshops and teachers who had not participated. Principals, portal leaders, the science supervisor, central administration officials, and the University of Wyoming's field coordinator for the portal school program were also interviewed.

Following this site visitation, questionnaires were developed for administration to teachers, principals, portal leaders, and science supervisors in the four portal schools. The domain for these questionnaires included the following topics:

1. Communication processes in the program.

2. School district motivation for participation in the program.

3. School district commitment to the operation of the portal school.

4. Content, processes, and effects of the portal school workshops.

5. Availability of science curriculum materials in the portal school.

6. Selection and training of portal leaders.

Specific questions were then written from this domain for the various questionnaires. Although separate questionnaires were developed for teachers, principals, portal leaders, and science supervisors, there was some overlap of questions in the four forms. There were also slight differences in the forms developed for elementary and secondary portal schools. Time did not permit pilot testing the questionnaires, but they were recycled about four to six times for revisions by the evaluation team.

The procedure used for selecting schools to receive these questionnaires varied for each portal school. Since we were not evaluating specifically the four portal schools but rather the usefulness of the portal school concept, we did not insist on representativeness of the teacher and principal samples for the elementary portal schools. In the large urban school district, ten elementary schools were selected at random, but one school was later removed from the list because it had been closed. The elementary science supervisor then suggested three additional schools from which he felt it would be useful to gather data. Ten elementary schools were also randomly selected in the medium-sized school district, and the science supervisor then added one school from which he felt it would be useful to gather data. For the secondary portal school in the large urban district, however, the questionnaires were sent to all junior high school science teachers and principals. Only junior high schools were selected because very few senior high school teachers have participated in the portal school. In the sparsely populated region, the questionnaires were sent to all junior and senior high school science teachers and principals. All portal leaders and science supervisors in the four portal schools were sent the questionnaires developed for them.

In February the portal school questionnaires were mailed to the science supervisors in the school districts with the four portal schools. They, in turn, distributed the questionnaires to the portal leaders, principals, and teachers. One exception to this procedure occurred in

the secondary regional portal school where teacher and principal questionnaires were mailed directly to the principal. A questionnaire was also sent to the University's coordinator of the portal school program for information on each of the four portal schools. The questionnaire response rate is summarized in Table 2. With the exception of the principal and teacher questionnaires in the urban school district, the questionnaire data were analyzed prior to the final site visitations.

A science educator was included on each visitation team for the final site visits. Roger Johnson, an elementary science educator at the University of Minnesota, accompanied Bracht and Fehrenbacher to the elementary portal schools in March. Richard Clark, the science consultant with the Minnesota State Department of Education, joined Rogers and Campbell on the secondary visitations. As during the initial visitation, science supervisors, portal leaders, principals, and teachers were interviewed. Teacher workshops were observed in all four portal schools. Documents used in the program, such as announcements, workshop handouts, and syllabi, were also collected. In Table 2 we have reported the number of schools visited, workshops observed, and persons interviewed.

The interviews were not structured. Interviewers were encouraged to use a style that they find comfortable and to explore and pursue information that might be useful for the evaluation. However, some direction was given to the interviewers by defining six general areas of information:

1. Communication processes between the university and the portal schools and within the portal schools.

2. Motivation and commitment of the school district to the portal school.

3. Content and processes of the portal school workshops.

4. Application of the science curricula by teachers in their classes.

5. Performance of portal leaders.

6. Training of portal leaders.

About 15 to 35 questions were developed for each of these topics. These questions were not intended to be asked in each interview but formed a pool of questions which the interviewer could use in planning and conducting the interview. Although the use of the questions varied, the interviewers obviously used them less frequently during the latter days of the visitations.

TABLE 2

DATA COLLECTION SUMMARY

Data Collection Methods	Portal School A*	Portal School B	Portal School C	Portal School D
Questionnaires:				
Schools in sample	12	11	18	12
Date returned	April	March	April	March
Personnel surveyed#				
Teachers	119/162	75/105	100/124	37/50
Principals	11/12	11/11	17/18	12/12
Portal leaders	14/21	3/3	2/2	3/3
Science supervisors	1/1	1/1	1/1	1/1
Site Visitations:				
Date of visit	March 29-30	March 28†	April 10-11	April 12-13
Schools visited	7	5	5	5
Workshops observed	2	2	1	1
Personnel interviewed				
Teachers	33	20	23	28
Principals	6	3	5‡	4
Portal leaders	6	2	2	3
Science supervisors	1	1	1	1

*The following code can be used to identify the portal schools:
Portal school A - Elementary, urban district
Portal school B - Elementary, medium-sized district
Portal school C - Secondary, urban district
Portal school D - Secondary, sparsely populated region.

#The number to the left of the slash indicates the number of questionnaires returned. The number to the right of the slash indicates the number of questionnaires sent.

†A preliminary site visitation was also made to this school district on January 4-5 during which two schools were visited. Interviews were conducted with nine teachers, two principals, two portal leaders, the science supervisor, two central administration officials, plus the field coordinator for the portal school program.

‡Includes assistant principals.

Teachers, principals, and portal leaders usually were interviewed in their schools. Principals and portal leaders were interviewed individually in most cases, but teachers were often interviewed in groups of two or three. Sometimes each member of the visitation team was conducting a separate interview while at other times two or three interviewers were together. Science supervisors were interviewed several times during the visitation.

The elementary visitation team also spent one day at the University of Wyoming. The team interviewed the following persons about the design and operation of the portal school program:

1. Sam Harding, Director of the University of Wyoming Comprehensive Project.

2. Vincent Sindt, Coordinator of the portal school program.

3. Ronald Beiswenger, Paul Geisert, Robert Kansky, and Margariete Montague of the Science and Mathematics Teaching Center.

4. Gerald Meyer, Dean of the College of Arts and Sciences in which the Science and Mathematics Teaching Center is located.

5. Paul Kepper and John Christopher of the Extension Division.

The reader is cautioned that our information about the portal school program was obtained primarily from four portal schools. While it is better to portray four portal schools than one, we do not know whether similar judgments would have been made about the portal school program if a different sample of four portal schools had been selected for the study. On the other hand, the coordinator of the portal school program and the other members of the Science and Mathematics Teaching Center examined a preliminary draft of the evaluation report and found only one major difference between the findings of our four portrayals and their experiences with the entire program.

UNIVERSITY RESPONSIBILITIES IN THE PORTAL SCHOOL PROGRAM

We have identified three major categories of university responsibility which are important factors in the portal school program:

1. Organizing university resources.

2. Establishing portal schools.

3. Training, certifying, and supporting portal leaders.

While these responsibilities do not exist independently of the school districts, we think the major responsibility for their effectiveness lies at the university.

ORGANIZING UNIVERSITY RESOURCES

The Science and Mathematics Teaching Center (SMTC) of the University of Wyoming is the focal point of the portal school program. The SMTC was established to improve the preservice and inservice training of science and mathematics teachers. The inservice component is performed primarily through the portal school program. The center contains curriculum materials and supplies and has facilities for working with materials and demonstrating their use to teachers. In addition, faculty members conduct research and development activities on various problems of science and mathematics instruction and the learning process.

The SMTC receives its operating budget through the College of Arts and Sciences, but is is staffed jointly by the College of Arts and Sciences and the College of Education. The courses offered by the SMTC, both preservice and portal school courses, are listed in the Department of Natural Science. This department does not have a staff or budget and exists only as a mechanism for offering courses in science education. This arrangement provided the SMTC with the opportunity of defining courses for the portal school program so they could meet the needs of elementary and secondary science teachers in their specific situations.

A major feature of the course descriptions is the flexibility of content which may be presented in the course. Hence different elementary workshops with the same course number may cover, for example, (1) exploration of the ESS, SCIS, and SAPA curricula, (2) exploration of the ESS and SCIS curricula, (3) implementation of the SAPA curriculum, (4) implementation of the SCIS curriculum, etc. The courses offered through the Department of Natural Science are listed in Table 3. Another aspect of the flexibility is that courses are defined with variable credit.

A second major feature of the course descriptions is the emphasis on application in the science class. The descriptions convey the idea that an elementary or secondary teacher who has had successful experience in using the curriculum materials would be most qualified to teach the course. This idea coincides, of course, with the portal school design--using local teachers rather than university professors as portal leaders.

The SMTC carries out all of the financial transactions associated with the portal school program. It collects the tuition from workshop participants and makes disbursements to the extension division (for course registration and recording on transcript), portal leaders (for salary), reserve fund (for subsequent portal school activities), and the revolving fund of the SMTC. The last section of this report contains more information about the financing of the portal school program.

TABLE 3

COURSES OFFERED IN DEPARTMENT OF NATURAL SCIENCE

Course Number	Course Title
669M	Science for Elementary School Teachers
670M	Physical Science for Secondary School Teachers
671M	Biological Science for Secondary School Teachers
869M	Seminar in Science for Elementary School Teachers
870M	Seminar in Physical Sciences for Secondary School Teachers
876M	Investigations in Natural Science for Elementary Teachers
877M	Investigations in Natural Science for Secondary Teachers

Although the SMTC has designed and established the portal school program without some of the traditional constraints of university policy and procedures, it is important that the center coordinate its activities with other university units. Since the SMTC has benefitted from some exceptions to university policy and procedure in the ways it receives and spends tuition money, certifies instructors (portal leaders), and conducts course registration, conflicts have occurred with the extension division and the College of Education. Problems of this sort should be resolved in order to maintain effectively the portal school program.

In many universities, the several faculty members in an area of specialization, e.g., science education, generally function independently of each other. Beyond teaching assignments, each faculty member decides for the most part in what ways to be involved in disciplined inquiry, service, and governance. The SMTC has had the effect of bringing together the faculty in science and mathematics education to work on a common mission. As a group they usually reach consensus about high priority needs on which they can focus their activities. While individual faculty members still have the opportunity to decide on ways of personal involvement, they can now coordinate their disciplined inquiry and service activities with other faculty members. We think strong faculty commitment to a coordinated and focused program is essential for a successful portal school program. While it may be possible to have this coordination and focus without a formal center like the SMTC, there seem to be some advantages in having the formal organization:

1. The center gives the faculty member a stronger identity with a program. Departments are organizational units for administrative purposes and hence provide the faculty member with an artificial sense of identity. The faculty member probably obtains greater satisfaction from his identity with a program, e.g., science education, rather than with an administrative unit, e.g., elementary education. The advantage of a formal program organization, e.g., Science Teaching Center, over an informal program designation, e.g., science education, is that the formal center is probably more explicit in defining its goals, and hence the faculty member is more likely to make a strong commitment for involvement in the portal school program.

2. The center is more organized than an informal program designation and tends to focus in a coordinated way on activities which support the portal school program. The formal center is generally more efficient and productive.

3. A center can achieve considerably more visibility. The success of the portal school program has given the SMTC

substantial visibility in the university's central administration. This has implications, of course, for budget and other decisions. We were also told that the SMTC, through the portal school program, has impressed a number of state legislators.

While some type of formal organization may be desirable for universities to establish successful portal school programs, that obviously is not sufficient. The organization consists of people and they must be strongly committed to its goals. Merely substituting a formal organization for an informal group may be counter-productive.

ESTABLISHING PORTAL SCHOOLS

The portal school program is designed to deliver the services of the SMTC to the school districts by establishing portal schools. The first step in delivering the program to the school districts is publicity. The SMTC relies heavily on its field coordinator to publicize the program. He is well known in the Wyoming region, having served as science consultant for both the Wyoming and Colorado State Departments of Education. His previous relationships with many school administrators and science teachers has facilitated his efforts to present the program to school districts.

Another means of publicity occurs when enthusiastic participants tell others about the program. One of the school districts visited was introduced to the portal school program in this way. The field coordinator reported that other districts have also contacted the SMTC after receiving information about the program from colleagues. Finally, the SMTC publishes a newsletter which is distributed widely to science teachers and schools in the Wyoming region.

The university's second step in establishing a portal school is to facilitate school district planning for the program. Again the field coordinator assumes primary responsibility. He visits with the science supervisor or school district administrators to discuss the district's science instruction needs. If both he and the school district administrators agree that a portal school could be an effective instrument for curriculum change, the school district must then develop a statement of its goals for the portal school. In one of the portal schools we visited, this initial contact with the central administration and the statement of goals was not made. Instead, the program was developed by the SMTC and the teachers. As a result, it did not seem to be directed strongly toward any school district goal and did not receive strong support from the school district's central administration.

Assessing school district needs in science instruction is an essential stage in establishing a portal school. We suggest that it be done in a systematic way with input from teachers, principals, and others with a responsibility for curriculum and instruction. The needs assessment should be planned; it cannot be done adequately in a two-hour meeting. It is the university's responsibility to stimulate the school district in assessing its needs and to suggest strategies for conducting the assessment. In some cases the needs assessment has already been done before the field coordinator starts working with the district.

It is useful to classify the school district needs into the categories of exploration, implementation, and creative expansion as the field coordinator has been doing. This leads then to formulating goals

and a portal school plan for the district. The university should examine the plan and help the district to clarify its intents. The university should emphasize that the portal school is the school district's program for responding to its science instruction needs. It is not a program where the university provides instructional services directly for teachers' needs and interests, but it is a program where the school district can use the resources of the university to provide an inservice program which meets the district's needs.

After assisting the school district in assessing its needs and formulating a general portal school plan, the university should seek a commitment from the district to support the portal school. This includes a commitment to both leadership and financial support from the central administration. Someone in the district should be designated with the responsibility of directing the program and funds should be committed for purchasing instructional materials. The field coordinator must then decide whether the school district has made a commitment to an adequate level of support for a successful portal school.

Then the field coordinator helps the school district to select portal leader candidates. He emphasizes that the portal leader candidate should be a teacher who has been successful in teaching science and is interested in helping other teachers to improve their science instruction. The leader must be able to develop rapport with fellow teachers and display enthusiasm for science instruction. After the field coordinator and the school district reach consensus on a teacher's potential, that teacher is asked to become a portal leader candidate. Larger school districts usually have a science supervisor who assumes primary responsibility for selecting portal leader candidates. The candidate, however, does not become a portal leader until certified by the SMTC. The leadership training and certifying functions are described in the next section.

TRAINING, CERTIFYING, AND SUPPORTING PORTAL LEADERS

The minitute is the term used to describe the leadership training institute for portal leaders. The minitutes are conducted in the SMTC and consist of one to six weeks (usually three weeks) of interaction between portal leader candidates and the faculty and materials of the center. The purpose of the minitute is to prepare the portal leader to conduct workshops to meet the specific needs of his school district. The portal leader receives graduate credit through the Department of Natural Science for his participation.

The content studied at the minitute varies with the needs of the candidate and the needs of his school district, but generally includes the following topics: (1) teaching strategies, with special emphasis given to the philosophy and use of the inquiry approach; (2) curriculum materials, with emphasis on the materials produced by NSF curriculum development projects; (3) skills in inter-personal relations; and (4) strategies for planning and conducting workshops.

The minitute follows a "come, help yourself" theme and places the candidate in an unstructured, self-directed environment. The portal leader candidate comes to the minitute with an awareness of the school district's needs and its general portal school plan. After being informed about the faculty, materials, and facilities that are available, the candidate is encouraged to strike out on his own in preparation for his portal leader responsibilities. Attendance at seminars, films, demonstrations, and group activities is optional. The only specific assignment is that the candidate must produce a detailed workshop plan for the school district's portal school. The field coordinator and other faculty members evaluate the plan and help the candidate to locate and develop the resources which are needed to conduct the workshop.

The faculty of the SMTC described two advantages in the unstructuredness of the minitute. The first relates to opportunity for individualization. The candidate must develop a workshop plan for a specific school and then prepare himself to conduct it. Since there are unique features in the needs of each school district and each candidate, the minitute must be unstructured to some extent.

The faculty also claims that the unstructured environment provides a good test of whether the candidate will be an effective portal leader. The candidate is required (1) to take the initiative in developing a course, (2) to seek out and use appropriate resources in developing a course, (3) to produce a course plan with meaningful content and structure, and (4) to work independently when adequate resources are available. The few participants in the minitute who have not measured up to the criteria have recognized their weaknesses and voluntarily withdrawn as candidates for portal leaders.

Many of the portal leaders expressed dissatisfaction with the unstructured environment in the minitute. When asked in an open-ended question about modifications they would recommend in the minitute, about one-third volunteered that more structure would have been helpful. They also suggested better organization of the content presented in the minitute and more guidance in planning their own workshops. Suggestions were also made for more materials and more time at the minitute. On the other hand, many portal leaders reported that the unstructuredness was very useful to them. Perhaps the degree of structure should be contingent upon the individual need for it.

Concerns about the content and structure of the minitute and the certification process were expressed by a number of people we interviewed. Since these concerns surfaced late in our data collection, we do not have adequate information for making judgments about these issues. This area should receive additional study before other institutions plan to implement portal school programs.

One of the portal schools is conducting a minitute within the school district during the summer of 1973. Instead of transporting its teachers to the university for the leadership training, this school district is importing some of the SMTC faculty and materials in addition to using some of its experienced portal leaders as staff for the minitute. This minitute will be more structured than those conducted at the university. While the SMTC feels that the move to a school district site sacrifices the richness of the resources available to the portal leader candidates, the school district feels that the convenience and economy of having the minitute "at home" will increase the number of participants.

After the workshop plan has been approved and the portal leader has been certified, he is prepared to conduct portal school workshops. One of the school districts we visited has added the requirement that the portal leader must use the curriculum materials in his class before conducting a workshop about the curriculum. The other school districts have accepted the university certification as sufficient evidence of competency.

After certification, there is little observation of the portal leader's activities by the SMTC. The field coordinator or other SMTC member usually is present at the first session of each workshop. Otherwise, portal leaders are encouraged to contact the field coordinator when they have questions or need assistance. The usefulness of this procedure is limited, however, by the initiative of the portal leader and his ability to identify and diagnose his needs.

An effective communication link must be established between the university and the portal school to assure a smoothly running operation. Several portal leaders and at least one science supervisor indicated

that it is very important to have one person at the university who is identified as the contact person. The field coordinator serves this function, but it is often difficult to contact him since much of his time is spent away from the university campus. Portal leaders and school district science supervisors have suggested that a staff member who is regularly on the university campus should also function as a contact person.

The only formal observation of the portal leader's workshop performance involves a questionnaire which participants complete at the end of the workshop. Although we have not observed any problems in portal leaders performing their functions effectively, we suggest that the university develop a formal observation and support system for portal leaders when they are conducting their first teacher workshop. This may include, for example, a team teaching arrangement with an experienced portal leader, the science supervisor, or a teaching assistant from the university. Although such arrangements involve additional cost, they may be worth it. In school districts with science supervisors, the responsibility for coordinating, supervising, and supporting the portal leaders shifts for the most part to the local level. In other school districts, the university must maintain a major responsibility.

SCHOOL DISTRICT RESPONSIBILITIES IN THE PORTAL SCHOOL PROGRAM

We have identified three major categories of school district responsibility which are important factors in the portal school program:

1. Providing leadership and financial support.

2. Planning and conducting workshops.

3. Assessing portal school progress.

While there is considerable interaction between the school district and the university in performing these functions, we think the major responsibility for their effectiveness lies in the school district.

PROVIDING LEADERSHIP AND FINANCIAL SUPPORT

The portal school is designed to provide a "portal" between the resources of the university and the needs of the school district. Some school districts use the portal school to explore alternatives to the science curriculum they are using. The goal is to provide the teachers with an opportunity to survey the science curricula that are available and to decide which would best fit their needs. Other school districts use the portal school as a means of implementing science curricula which have been adopted. The goal is to provide teachers with the competency to use the new curricula in the classroom.

In the initial meetings with the field coordinator, the school district is encouraged to define its science instruction needs and formulate objectives for participating in the portal school program. The coordinator stresses that the school district must take responsibility for the direction of the portal school because the program's strength lies in its ability to be tailored to local needs. The university cannot direct all of the portal schools; school district commitment and leadership is essential.

Two of the portal schools we visited did not appear to have strong school district support. In one, an elementary program, the initial contact with the Science and Mathematics Teaching Center (SMTC) was made by the teachers themselves. The school district's central administration did not become involved in the program until later when a science supervisor was appointed. By this time several portal school workshops had already been conducted. The portal school workshops appeared to be similar to extension courses for teachers (with the exception that they were taught by a portal leader) rather than a school district program for meeting its science education needs. There have been nearly three years of exploration workshops and only recently have plans started to develop for making the transition from exploration to implementation. The other portal school without strong school district support serves secondary science teachers in a sparsely populated region. It encompasses several school districts and thus does not have one central administration to coordinate it. Although the science supervisor in the district in which the portal school is centered has provided strong leadership support, commitments from the school districts are not apparent.

Both of these portal schools are at the exploration level, but neither has had a firm plan for moving beyond exploration. In the secondary regional portal school, it is difficult to respond to implementation needs at a regional level because plans for implementation are made independently in each school district. In the elementary portal school we have observed the need for strong leadership support from a central level of authority, which did not exist until recently. It is our judgment that careful planning and a commitment of support are important prerequisites for a portal school. If the exploration workshops are intended

to provide efficient facilitation of adoption decisions and the implementation workshops are intended to achieve worthwhile changes in science education, someone in authority must help develop the plan, organize the activities, and provide leadership in directing the portal school. The school district's central administration must provide this leadership or support someone else who is providing it. In regional portal schools, other ways must be found to provide strong leadership.

In addition to providing leadership for the overall plan of the portal school, the school district must efficiently organize and manage the activities of the portal school. This includes publicity, scheduling of workshops, responding to needs of portal leaders and teachers, providing curriculum materials, etc. Workshops must be arranged to minimize conflicts with teacher schedules. Other important antecedents include the scheduling of portal leaders and facilities and providing an adequate supply of curriculum materials for each workshop. If there are problems in scheduling portal leaders, additional leaders should be selected and trained. Several portal leaders who have taught workshops continually for two years expressed a desire to teach fewer workshops or at least take "leave" for a term.

The scheduling of a workshop is followed by publicity to the teachers. Existing communication systems within school districts seem to provide the main channels for portal school publicity. While the means of communication vary from one school district to another, most teachers reported hearing about the portal school from the science supervisor, the science department head, the principal, and through school district memos.

Financial support by the school district is also essential for the operation of a portal school. The primary need is to purchase an adequate supply of science curriculum materials for both the workshops and the science classes. This and other aspects of financing the portal school are discussed in the final section of the report. The point we want to make here is that the school district must initially estimate the financial costs of the portal school and make a corresponding financial commitment before the portal school is established.

PLANNING AND CONDUCTING WORKSHOPS

The teacher workshops are the primary means of the portal school for achieving changes in the science curriculum. The following topics, which relate to planning and conducting a workshop, provide an outline for this section of the report:

1. Content in the workshops.
2. Instructional processes in the workshops.
3. Scheduling the workshops.
4. Materials for the workshops.
5. Teacher motivation to participate.
6. Teacher applications in science classes.

Content in the Workshops

The three general levels of exploration, implementation, and creative expansion are useful in defining the content of a workshop. Exploration workshops at the elementary level may explore science curricula such as SCIS, ESS, and SAPA; secondary workshops might explore ISCS or BSCS. Locally developed programs may also be included in the workshop. The participants examine the merits and shortcomings of the curricula, considering the needs of the students and their ability to adopt the style of teaching promoted by the program.

At the elementary level we observed exploration workshops which covered two or more curricula as well as explorations which covered only one science curriculum. It is claimed that a workshop on a single curriculum is an exploration because it assists the school district in deciding whether to adopt the curriculum or continue with the current program. However, there are multiple science curricula which are available at the elementary level, and it seems more worthwhile to include at least two or three of these programs in an exploration workshop.

At the secondary level we found that most exploration workshops include only one curriculum. Since there are a number of content areas in secondary science, the alternatives for each area are limited. Hence teachers are exploring the merits and shortcomings of a new curriculum in comparison to their current science program. Although a stronger case can be made at the secondary science level for including only one curriculum in an exploration workshop, we encourage the portal schools to explore all alternatives where multiple curricula are available.

The science supervisor, portal leaders, teachers, and the field coordinator have varying degrees of influence on the content of exploration workshops. For example, the science supervisor or a science curriculum committee may decide which curricula will be explored, and then the portal leader determines the content of the individual sessions. In other cases, the portal leader may be responsible for both types of decision. Teachers also may influence the content of the workshops; for example, the science supervisor in one district periodically surveys secondary science teachers to determine what workshops they would like to have. In addition, feedback from participants in a workshop may suggest the content for a subsequent workshop. Finally, the SMTC may make suggestions for an exploration workshop as it did during the past year by encouraging a number of portal schools to conduct an interdisciplinary environmental studies workshop for science and social studies teachers.

Implementation workshops focus on a specific curriculum. The purpose of the workshop is to prepare the teachers to use the adopted program successfully in their science classes. Topics in the implementation workshops include the teaching philosophy of the program, scope and sequence of the program, use of materials and equipment, teaching strategies, student evaluation, etc.

The portal school workshops do not focus directly on teaching science knowledge to the teachers. However, we observed that teachers do learn science knowledge by working with the curriculum materials in the workshop. Several secondary teachers expressed a preference for more science knowledge. This issue should be handled in each portal school by first assessing the needs of the teachers and then developing a workshop plan which corresponds to the teachers' needs. In most cases the portal leader or a team of portal leaders can effectively present the science knowledge which is needed. Occasionally it may not be possible to find a portal leader who is competent to teach a unit or more of science knowledge that the teachers need. The portal school should then explore a co-leadership arrangement with the SMTC whereby the portal leader would share teaching responsibilities with a university professor. Such an arrangement could provide an opportunity for increasing advanced science knowledge without losing the valuable practical orientation of the workshop.

Perhaps the best way of preventing the misuse of the exploration workshops is for the field coordinator to insist on a clearly specified plan for the exploration phase. Then a procedure could be established for checking each workshop proposal for its congruence with the overall exploration plan. The exploration workshops should be a means for moving into the implementation phase. In most cases it should not be necessary for the exploration phase to continue more than one year, especially if a district-wide adoption of a single curriculum is planned. The number of teachers who participate extensively in the exploration activities depends on local circumstances, but generally a small number of teachers (perhaps 20-50) is sufficient. These teachers should then participate in making the adoption decision. Other teachers could participate in

shorter exploration workshops (equivalent to a one-credit course) to obtain an overview of the curricula which are being explored by the school district. Where adoption decisions are decentralized, it may be necessary to schedule the workshops over a longer period and involve more teachers in the exploration. This obviously applies to the secondary regional portal schools where adoption decisions are decentralized in the school districts.

It appears that most secondary science teachers who have participated in an exploration workshop are able to implement a new curriculum without participation in an implementation workshop. There seem to be two reasons for this: (1) The secondary exploration workshop in most cases is an intensive study of a single curriculum and hence is similar to an implementation workshop. (2) Most secondary science teachers have extensive training and experience in science education whereas most elementary teachers have relatively little training and experience in science education. Hence elementary teachers may accrue the greatest benefit when highest priority is placed on implementation workshops with lower priority on exploration. We are not suggesting that exploration should be deleted from elementary portal schools but that implementation should receive greater emphasis than exploration. Secondary teachers, however, generally prefer to explore before making a commitment, and then they proceed with the implementation without formal assistance.

The exploration of curriculum alternatives is an important stage in the total process of making curriculum changes. However, we are concerned that an individual portal school may be misused in the absence of clearly specified school district goals for the exploration. In two of the portal schools we visited, the teachers responded more frequently that they have participated in the workshops primarily because it is easier to get academic credit. Several teachers in one district reported that they have accumulated nine semester credits by repeating exploration workshops. We were given the impression that these portal schools were serving the personal needs and interests of the teachers at the expense of attaining planned changes in the science curricula of the school districts. We contend that there is considerably more payoff for both the school district and the teachers at the implementation stage, and hence exploration should be restricted to a relatively shorter time interval.

Instructional Processes in the Workshops

The highest priority in all workshops we observed is given to teacher experiences with the curriculum materials. The teachers usually work with these materials in small groups of two to five members. When asked how time was spent in a workshop, participating teachers from all four portal schools mentioned the small-group activity more frequently than any other activity. In two portal schools some teachers also reported that they worked individually with the materials. Small group discussion was also mentioned as a frequent activity in one portal school. Observation of several workshops indicated that such discussion was probably related to the experiences teachers were having with the curriculum materials.

The role of the portal leader also varies. The teachers in one portal school indicated that the leader frequently conducted demonstrations. In the other portal schools, however, such activity was rarely mentioned. Discussion involving the entire group was reported as a frequent activity in three portal schools but not in the fourth. The leader in one portal school often discusses with the group such topics as safety precautions, storage procedures, and grading alternatives, but the leader in another portal school has the teachers work with curriculum materials during the entire session. Another leader uses films and guest lecturers frequently. Sometimes a leader discusses briefly with the group some of the principles involved in the activity; in other cases the teachers are left to learn the principles on their own.

Since the new science curricula emphasize the inquiry method of learning and most teachers have had little or no experience with the use of this method, the inquiry method has been used extensively as the teaching process in many workshops. Instead of teaching the participants about the new science curricula by lectures, demonstrations, and readings, the portal leaders emphasize teacher experiences with the curriculum materials. The teachers, in effect, perform the same role that their students would perform in science class and thus discover the concepts and principles of science by interaction with the materials. This process seems essential if the teachers are going to develop a comfortable feeling for the inquiry method of learning.

We question, however, the nearly exclusive use of the inquiry method by some portal leaders. First of all, use of the inquiry method as the only instructional process is an inefficient use of workshop time. It is important for the teachers to have extensive practice with the method of directed inquiry, but it restricts the amount that can be learned in the short time of a workshop. It is our judgment that the payoff was greater in those workshop sessions where a period (about 30-45 minutes) of inquiry with the curriculum materials was followed by the portal leader's (1) suggestions of how the inquiry could be continued, (2) brief demonstrations of additional activities, (3) discussion of the science content which is learned in the activity, (4) discussion of practical problems in using the materials with science classes, and (5) discussion of the relationship of the activity to other units in the curriculum.

The second problem with exclusive use of the inquiry method in the workshops is that extensive practice of the student's role does not necessarily lead to an understanding of the teacher's role in using the inquiry process. Several teachers whom we interviewed reported that their students were bored with the new curriculum because they finished the lessons in a very short time. Further questionning revealed that these teachers did not encourage the students to make inquiries as is intended for the program. Teachers should be given an understanding of the philosophy of instruction which is recommended for the curriculum. In addition, portal leaders should describe clearly the role of the teacher and illustrate explicitly the various strategies which can be used in directing an inquiry. Consideration should also be given to providing opportunities for the teachers to practice the teacher role in the workshop.

The SMTC discourages extensive assignments for the workshops and instead encourages the portal leaders to stimulate the teachers to try some of the curriculum materials in their classes while they are enrolled in the workshop. This suggestion is generally followed in the four portal schools as most teachers reported that they were required to do little or no work between workshop sessions. The assignments they mentioned, however, were generally quite practical, such as observing a science class where a new curriculum is being used, trying new curriculum materials with a class, reading about a new curriculum, reading about methods of teaching science, writing an evaluation of workshop activities, and studying concepts and principles of science. On the other hand, most of the teachers reported voluntary activity between sessions. Of the teachers surveyed by questionnaire, 78 percent claimed they had voluntarily tried out the new science materials in their class. Other frequently mentioned voluntary activities were: reading about new science curricula (58 percent), reading about ways of teaching science (45 percent), and studying concepts and principles of science (39 percent).

Based on questionnaire data, the teachers seem satisfied with the processes of the workshops. Eighty-five percent of the participating teachers who were surveyed in the four portal schools stated that the presentations in the workshop sessions were effective. In addition, 82 percent of the teachers stated that they received more than adequate instruction on how to use the materials in their classroom. Seventy percent of the teachers were satisfied with the way the workshop sessions were organized.

Scheduling the Workshops

Most portal school workshops are scheduled during the late afternoon after classes have been dismissed. Teachers are usually exhausted at this time of day, but those interviewed felt the convenience of going from school directly to the workshop overrides the fatigue factor. Evenings, weekends, and summers are less desirable for most teachers. Exceptions to this pattern, however, do exist. Since some secondary workshop participants in the sparsely populated region must drive as far as 75 miles one way, the sessions are held in the evening. Also one secondary workshop in the large urban district was held during the summer. None of the teachers who participated in workshops reported any dissatisfaction with the schedule. Only 17 percent of those teachers who have not participated in a workshop claimed that inconvenient scheduling was a major factor for their lack of participation.

Many of the workshops are scheduled for 17 weekly sessions of two and one-half hours each. This corresponds to a three-credit semester course. The urban elementary portal school has also scheduled ten-week and five-week workshops for two and one credit, respectively. These workshops appeal to some teachers who otherwise would not enroll. The shorter workshops have also been used to provide teachers with a second workshop experience, this time after they have practiced the ideas which were

learned in the first workshop. The availability of alternative workshops seems to satisfy the preferences of teachers. Of those teachers in the urban elementary portal school who were surveyed by questionnaire, 88 percent rated the number of weekly sessions as about right.

One advantage of the portal school program is that the workshops are conducted in the local school district rather than at a university. Some school districts have established a center for the portal school where curriculum materials are stored and workshops are conducted. In addition to the central location, the urban elementary portal school has scheduled the shorter workshops in schools where a minimum enrollment is assured. Thus many teachers can attend a workshop in their own building, a considerable convenience for most teachers in a large urban area. The teachers reported satisfaction with the location of the workshop with 92 percent of the urban elementary teachers rating the location as convenient to very convenient.

Even though they have attended an implementation workshop, teachers still encounter unanticipated problems when they are implementing a new curriculum. Teachers can discuss these problems with other teachers in the school, but there seems to be a need for planned and organized opportunities to interact with other teachers who are using the program, especially teachers at the same grade level. The teachers suggested follow-up sessions to seek assistance with problem areas and share ideas for using the curriculum effectively. Teachers would not enroll in these sessions for credit and could participate as frequently as they preferred. We strongly encourage portal schools at the implementation stage to develop and adopt a plan of this type.

Materials for the Workshops

The science curriculum materials are a very important part of a portal school workshop. The teachers use the materials in both the workshop sessions and their science classes. Most teachers will be stimulated to try the curriculum only if an adequate supply of materials is conveniently available. One way of providing access to the materials is to store them in a central location within the school district. Teachers can then check out the materials for a period of time. And indeed teachers do check out materials regularly while they are enrolled in the workshop if an adequate supply is available and the portal leaders encourage them. Problems occur, however, when the workshop is not conducted in the same location where the materials are stored or an adequate supply of materials is not available. These problems can be minimized though if the school district has made a commitment to provide strong financial support for the portal school.

One of the school districts in the exploration phase has selected "pilot" schools for an extensive tryout of the alternative science curricula. Although there are strong merits in this approach, we emphasize that its effectiveness is contingent upon having an adequate number of curriculum kits in each "pilot" school.

Another problem occurs during the implementation stage when a teacher has participated in a workshop, but the curriculum materials have not been ordered for that teacher's class. In the urban school district we portrayed, instructional budgets are decentralized so that the new science curriculum is ordered at different times by various schools. Hence some teachers have taken the workshop and are eager to implement the new curriculum, but materials are not available. The situation is quite frustrating for the teachers, and efforts should be made to purchase or borrow one set of materials for these schools during the interim.

Teacher Motivation to Participate

The portal school has failed, of course, if teachers do not participate in the workshops. Three factors seem to account for most of the reasons that teachers gave for participation. First, there is an important payoff in learning how to use a new curriculum and improving their science instruction. Teachers stressed the practical orientation of the workshops; they learned things which were immediately applied in their science classes. Related to this is the fact that portal leaders are fellow teachers who have experienced the thrills and frustrations of using the new curricula. Questionnaire data also support the educational value of the workshops for the teachers as a major motivating factor. The most frequently mentioned reasons given for participation in the workshops were to learn more about ways of teaching science and to learn about new science curricula.

A second important incentive is that the teachers receive graduate credit for the workshops. Academic credit was mentioned frequently in both the questionnaires and the interviews as a reason for participation in a workshop. This credit can then be used to meet recertification requirements, to raise a teacher's standing on the pay scale, or to meet requirements for a graduate degree. Academic credit is most important as an incentive in those portal schools where teachers pay their own tuition.

The scheduling of the workshops is a third factor that can motivate teachers to participate. Since the workshops are held within the school district (with the exception of regional portal schools), travel distances are significantly reduced from what they would be for a university course. Even in the sparsely populated region where some teachers drove as far as 75 miles one way to attend a workshop, this distance was still shorter than to the nearest university. Scheduling workshops in the afternoon appeals to most teachers, and the shorter workshops have provided an incentive for some teachers who otherwise would not participate.

Teacher Applications in Science Classes

The portal school is successful to the extent that it facilitates improvements in the school district's science curriculum. It is intended

then that teachers will apply the new materials and teaching ideas in their classes both during and after the workshop.

While the workshops are in session, teachers are encouraged to try some of the activities with their classes. If the necessary materials are not available at the teacher's school, it is usually possible to check out the materials from a central storage facility in the district or borrow them from the portal leader. The responsibility for actually using the materials, however, rests with the individual teacher. The portal leader suggests activities which teachers can try, but each teacher must take the initiative in applying the materials and ideas.

From the questionnaire data, it appears that application in science classes is more likely to occur during elementary workshops than during secondary workshops. It seems that elementary teachers generally are eager to substitute an activity or unit for lessons in the "old" curriculum. Secondary teachers said there are problems in trying activities from the new curriculum, including the organization and sequence of topics in the course. Some secondary teachers reported that next year they will be teaching a different course in which they will use the new curriculum, but the materials are not appropriate for their current science classes.

Where classroom application did not occur, it was apparently for reasons other than lack of materials. Seventy-two percent of the teachers reported that curriculum materials were conveniently available for use in their classes while they were enrolled in the workshop. In only one portal school did a significant number of teachers claim the materials were not available. In addition, for secondary teachers it is generally inconvenient to transport from a central storage facility all the materials which are needed for an activity.

After participating in an implementation level workshop, the teacher is expected to use the new curriculum in the science class. Such use, however, is contingent on the availability of the materials. This is where the central administration of the school district (perhaps also the school principal) is responsible for purchasing an adequate supply of materials so teachers are not delayed in making the implementation. Delays are costly in terms of teacher motivation, teacher time required for reviewing when materials do arrive, and depriving students of immediate educational benefits.

Besides the availability of materials, encouragement and support for the teachers are also important. Support can be provided by (1) portal leaders, especially for the teachers in the same building where they teach, (2) the science supervisor, and (3) science department heads or resource teachers. The urban school district attempts to develop strong leadership in each school for the curriculum being implemented. This person(s) can assist the teachers with their implementation problems and suggest activities and procedures which are effective in other classes. The follow-up sessions which were suggested in a previous section, Scheduling the Workshops, may be a useful mechanism for the school leader to use.

In the portal schools that we portrayed, there is evidence that classroom application has occurred. The urban school district has implemented SCIS in 74 of 93 elementary schools. Six of 18 junior high schools have implemented ISCS. In the sparsely populated region, a number of schools are using ISCS, BSCS, or Harvard Project Physics. The science educator on the visitation team reports that this is an unusually high degree of implementation for such a remote area. Finally, 73 percent of the teachers in the four portal schools indicated that they are now using different curriculum materials in their science classes as a result of the portal school.

In the urban junior high schools where implementation of ISCS has not occurred, difficulties in finding storage facilities must first be overcome. Junior high schools which have implemented ISCS often differ from those which have not by having more space to store the necessary equipment. Low student reading level was also stated as a reason for lack of implementation in some schools.

In addition to the use of different science materials, changes in teaching methods have occurred as a result of the portal school program. Eighty percent of the teachers who have participated in workshops reported that their students are now more actively involved in doing experiments and in working with materials. Fifty percent reported that they now do less lecturing. Sixty-three percent of the participating elementary teachers are now more enthusiastic about teaching science. Most teachers who have not implemented a new curriculum did report in the interviews, however, that they have changed the style or teaching science.

General Conclusions About the Workshops

Teachers generally are enthusiastic about the portal school workshops. They like the practical orientation of the sessions and have suggested workshops for other curriculum areas as well. Nearly all teachers who have participated in workshops rated them on the questionnaire as successful to highly successful on the following four criteria:

1. As a means of improving science teaching (97 percent).

2. As a means of improving knowledge of science (90 percent).

3. As a means of learning about new science curricula (98 percent).

4. As a means of meeting the school district's needs in science education (93 percent).

When asked about the outstanding features of the portal school program, 71 percent of the teachers stated that they can readily apply what is learned in the workshops to their science classes. Other outstanding features which the teachers mentioned include developing a knowledge and

understanding of science which many teachers have lacked (44 percent) and the emphasis on good methods of teaching science in the workshops (43 percent).

In addition to generating teacher enthusiasm, the workshops also seem to accomplish their goals. Where designed to implement a science curriculum, this implementation is, in fact, occurring.

ASSESSING PORTAL SCHOOL PROGRESS

After the school district has identified its science education needs, it plans and puts into operation a portal school for responding to the needs. At this point the school district should begin to assess the progress which is being made in attaining the goals which were established for the portal school. In this section we are suggesting ways in which the school district might develop a procedure for assessing progress.

Consider the following examples of portal school goals:

1. By May 1974, (a) about 25 elementary teachers will complete an extensive "pilot" study of the ESS, SAPA, and SCIS programs, and (b) all elementary teachers will have the opportunity to participate in exploration workshops on the ESS, SAPA, and SCIS programs and to try some of the activities in their science classes.

2. By February 1974, Levels I and II of the ISCS program will be implemented in all eighth grade science classes.

3. By September 1975, about ten high school science and social studies teachers will complete the development of an environmental studies curriculum.

Since each of these goals is stated as a terminal outcome, the next step is to formulate intermediate checkpoints. Suppose, for the second goal, that there are ten junior high schools in the school district. The portal school was started in June 1972 with the intent that all eighth grade science teachers within a school would make the implementation at the same time. A form like the example in Table 4 may be used to record the progress in attaining the goal. An X indicates that implementation has occurred in the school by the date shown at the top of the column. The report shows that the school district is maintaining its schedule for implementing the ISCS curriculum.

In Table 5 we have displayed a sample form for the first goal but without listing the names of all schools in the district. The numbers in the September 1973 column indicate the number of teachers who participated in the first workshop and are now doing the "pilot" study. The subsequent columns represent an accumulation of teachers from each school who have completed the exploration workshops. In this illustration we have not specified performance criteria because the goal is to provide teachers with the <u>opportunity</u> to explore. It is not intended that all teachers will explore the three curricula. The use of performance criteria, as in Table 4, are more appropriate during the implementation stage. The form is used then to record progress in an objective manner. This data can be used by the director of the portal school to identify schools where few or no teachers have participated.

TABLE 4

SAMPLE FORM FOR REPORTING PORTAL SCHOOL PROGRESS
OF ISCS IMPLEMENTATION

School	Sept. 1972	Feb. 1973	Sept. 1973	Feb. 1974
Blake			X	
Centennial		X		
Central			X	
Dexter				
Lakeview	X			
Mann				
Oakdale			X	
Portal	X			
Trimble		X		
Valley	—	X	—	—
GOAL:	2	4	8	10
PROGRESS:	2	5	8	

TABLE 5

SAMPLE FORM FOR REPORTING PORTAL SCHOOL PROGRESS
OF ELEMENTARY SCIENCE EXPLORATION

School	Number of Science Teachers	Number of Participating Science Teachers			
		Sept. 1973	Dec. 1973	Mar. 1974	May 1974
Anderson	8	0	1		
Columbine	14	6	10		
Forest	7	0	0		
Freedom	22	7	7		
Greenfield	20	7	15		
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
Whittier	11	0	3	—	—
	PROGRESS:	28	84		

In addition to the record forms described previously, the following types of data could be collected:

1. Teacher data on the workshops. The SMTC has been administering a questionnaire of this type to participants at the end of each workshop to evaluate the quality of the workshop.

2. Teacher data on applications in science classes. A questionnaire could be given to teachers periodically to assess the changes they have made in the science curriculum and the problems they are having.

3. Student data on applications in science classes. A questionnaire could be given to students to obtain their observations of changes in the science curriculum and the impact of the portal school program.

We do not recommend a complex system for assessing portal school progress. But several simple procedures for systematic data collection may enable the school district to operate a more efficient portal school with perhaps a higher quality of outcome.

FINANCING THE PORTAL SCHOOL PROGRAM

The financing of the portal school program involves the five types of expenditure listed on the left side of the matrix in Figure 1 and the four sources of money listed on the bottom side. A "yes" in the matrix indicates the actual source of funds (bottom of column) for each major category of expense (left side) in the University of Wyoming's portal school program. This section of the report contains a description of the expenditures and financial resources with judgments about financing the portal school program.

EXPENDITURES

	University	School District	Tuition	NSF
A. Field Coordination				yes
B. Development of University Services	yes		yes	
C. Training Portal Leaders			yes	yes
D. Salary for Portal Leaders			yes	
E. Curriculum Materials		yes		

FINANCIAL RESOURCES

Figure 1. Matrix of Expenditures and Financial Resources in the University of Wyoming's Portal School Program

Expenditures

Money is one of the important resources for implementing and maintaining the operation of a portal school program. Money is needed to: (A) provide personnel for the coordination of the program between the university and the school districts, (B) facilitate the development of university services for the program, (C) train the portal leaders, (D) provide a salary for the workshop leaders, and (E) purchase materials for workshop activities and teacher tryout in the science classes. In the following section we describe briefly the ways in which these expenditures are used.

A. The coordination of the portal school program between the university and the school districts is carried out primarily by the field coordinator. The outstanding progress which has been made in starting portal schools was facilitated extensively by his previous state department experience in both Colorado and Wyoming. A person with less experience in the region probably would have made slower progress. The scope of the coordination task depends on factors such as size of the region, number of school districts in the region, whether the program focuses on both elementary and secondary curricula or only one of the levels, and the number of school districts with science supervisors.

B. The services provided by the Science and Mathematics Teaching Center (SMTC) are an important component in the portal school program. The resources for these services include the staff, facilities, and materials of the SMTC. These resources are most obviously used in the training of portal leaders. In addition, the staff must be released to some extent from their other responsibilities so they can be available to assist school districts directly with their portal school activities. There is also a need for the SMTC to use staff time for developing instructional units, demonstrating the curriculum materials to teachers who visit the center, and conducting research and evaluation activities. Although the form in which the university resources are organized and the services are delivered will vary with institutions, money will still be needed to support the development of the services.

C. The training and certification of portal leaders are critical functions in the portal school program. In addition to covering the expenses of the minitute, it is probably necessary to offer a stipend to the teachers who attend the leadership training institute. Many of the teachers who are nominated to be portal leaders are not motivated by the opportunity to obtain additional university credits. Furthermore, they take on additional responsibilities after being certified as portal leaders. Since the salary of portal leaders is relatively small, some incentive, e.g., a minitute stipend, would help to attract some outstanding science teachers to the program.

D. At present the salary of workshop leaders is obtained through the tuition that is paid by the teachers. The salary is 30 percent of the workshop tuition. However, this is often inadequate, especially if there are a small number of participants in a workshop. When there are 25 or more participants in a workshop, the portal leaders generally

appear to be satisfied with the salary. However, the most appealing workshops for some teachers are the short workshops conducted within the school. Thirty percent of the tuition for these workshops does not at all represent adequate remuneration for the portal leaders. Within the current policy, the only way to adequately cover the salary of teachers is to conduct large workshops, and these generally are not the most effective workshops for all teachers. In one school district, the salary of the portal leader is supplemented by using money in the reserve fund.

E. Curriculum materials are needed for both activities during the workshop and teacher tryout in the science classes. While materials seem to be adequate for workshop activities, problems have occurred regarding the availability of materials for teachers to try in their classes. The urban school district has furnished a storage room with elementary science curriculum materials where teachers can check out materials. Since the storage room is in the same building where most of the workshops are conducted, many of the teachers check out new materials each week while they are enrolled in the workshop. Some science kits are stored in schools, and thereby the use of materials is even more convenient for teachers in that school. The extent to which teachers try the science materials with their classes depends on the convenience of the materials, and convenience seems to be related to the amount of materials provided by the school district (a significant cost factor) and the location of the materials.

Financial Resources

The current financial resources for the portal school program include the: (1) university budget, (2) school district budgets, (3) tuition from the portal school workshops, and (4) National Science Foundation grant. The functions supported by each of these financial sources are described in the next section.

1. The university budget supports B, the development of university services which are provided by the SMTC. The university should continue to support this function since it is an integral part of the SMTC and serves preservice, inservice, and graduate education programs.

2. School district budgets support E, the purchase of materials for workshop activities and teacher tryout in the science classes. Unfortunately, there is reluctance in some school districts to purchase science kits at the exploration stage. At the implementation stage, school districts may provide greater financial support for science kits because a particular program has been adopted. Since it is important that exploration precede implementation, some external funds may be needed in certain school districts, especially smaller ones, to purchase science kits at the exploration stage.

3. The tuition for the workshop is used as follows: (a) 30 percent is used for salaries of portal leaders; (b) 30 percent is placed into a reserve fund for future portal school expenses; and (c) 40 percent is placed into the revolving fund of the SMTC. The reserve fund may be used by school districts to pay tuition of future workshops (e.g., creative

expansion workshops), supplement portal leader salaries, pay expenses for training additional portal leaders, purchase materials for workshop activities, etc. The reserve fund provides a strong incentive for the school district to continue the portal school program. The revolving fund is used to support B, the development of university services for the portal school program; this includes a very small fee for maintaining formal university records through the extension division. The coordinator of the portal school program has reported that teachers pay the full amount of tuition in about half of the portal schools. In the other half, the school district pays part or all of the tuition for the teachers. Some teachers who have not participated in the workshops said they do not need university credits and others reported that they would wait another year or two until they needed credits for recertification. Hence we encourage school districts to provide workshop opportunities at reduced cost for teachers who do not need university credit so they will also have the incentive to develop the competency for implementing the new science curricula.

4. The grant from the National Science Foundation is used for A, coordination of the program between the university and the school districts, and C, training workshop leaders. The field coordination expenses include both the salary of the field coordinator and travel expenses.

General Conclusions About Financing

The portal school program is able to operate with relatively little external funding. This is due primarily to the large amount of tuition money which supports the program and the relatively smaller salaries for portal leaders (as compared to university instructors who teach extension courses). In the Wyoming project, all of the tuition goes directly to the support of the portal school program. This is not likely to occur at other universities where a large proportion of the tuition might be used for extension services and university overhead. Hence, other institutions should not anticipate the same uses of the tuition money that the University of Wyoming has enjoyed unless changes (or exceptions) can be made in university policy.

Other institutions should not anticipate that the portal school program can be supported without funds from external sources, as some have suggested. Although the amount of external funds has been relatively small, it would be difficult for the school districts to absorb additional expenses since the level of expenditure for portal leaders (both salary and minitute expense) is already below a satisfactory level. Furthermore, since other institutions are not likely to have the advantages of retaining the full amount of tuition for direct expenses of the portal school program, as the SMTC has, the need for external funding will increase. State departments of education are another source of funding which should be explored.

PORTRAYALS OF FOUR PORTAL SCHOOLS

We have prepared descriptions of the four portal schools which were included in the evaluation study. The portrayals include a summary of the activities which have been conducted as part of the portal school plan. These portrayals are intended for persons who find some appeal in the portal school program and are motivated to explore the concept further by examining the operation of specific portal schools. One or more of the four portrayals may be requested.

Portrayal A - Elementary portal school in urban school district with 93,000 students.

Portrayal B - Elementary portal school in medium-sized school district with 14,000 students.

Portrayal C - Secondary portal school in urban school district with 93,000 students.

Portrayal D - Secondary portal school in sparsely populated region with eight school districts and 11,000 students.

Copies of the portrayals can be obtained from:

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